

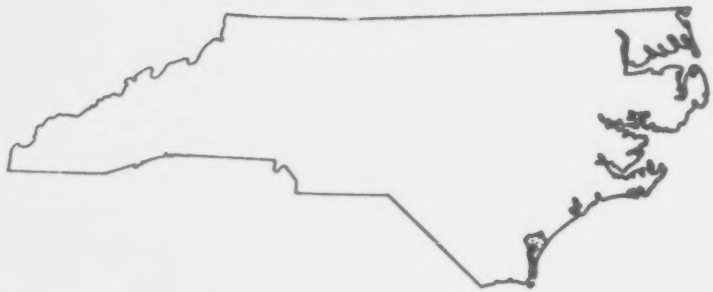
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FLOOD INSURANCE STUDY



**CITY OF WILMINGTON,
NORTH CAROLINA**
NEW HANOVER COUNTY



REVISED

NOVEMBER 4, 1987



Federal Emergency Management Agency

COMMUNITY NUMBER -370171

ORIGINAL

NOTICE TO
FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for floodplain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

This publication incorporates revisions to the original Flood Insurance Study. These revisions are presented in Section 9.0.

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Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

CITY OF WILMINGTON, NEW HANOVER COUNTY, NORTH CAROLINA

1.0 INTRODUCTION

1.1 Purpose of Study

The purpose of this Type 19 Flood Insurance Study is to investigate the existence and severity of flood hazards in the City of Wilmington, New Hanover County, North Carolina, and to aid in the administration of the Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. Initial use of this information will be to revise the Flood Insurance Rate Map developed from data presented in the Type 15 Flood Insurance Study. Further use of the information will be made by local and regional planners in their efforts to promote sound land use and flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the state (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The original hydrologic and hydraulic analyses for this study were performed by the U.S. Army Corps of Engineers (COE), Wilmington District (the Study Contractor) for the Federal Emergency Management Agency (FEMA), formerly the Federal Insurance Administration (FIA), under Inter-Agency Agreement No. IAA-H-16-75, Project Order No. 17. This work was completed in February 1977 and covered all significant flooding sources affecting the City of Wilmington. A revised coastal analysis was performed by Tetra Tech, Inc., for FEMA in December 1983 under Contract No. EMW-C-0344.

1.3 Coordination

The North Carolina Department of Natural and Economic Resources and local interests were informed of the initiation of the study and were requested to furnish available pertinent information. Information was also requested from the U.S. Soil Conservation Service (SCS), the National Oceanic and Atmospheric Administration (NOAA), and the U.S. Geological Survey (USGS).

A meeting was held with the FIA and local residents on December 5, 1974 to inform the community of the nature and purposes of the Flood Insurance Study, to solicit community input, and to identify streams requiring detailed study.

The original final coordination meeting was held with FIA, community officials, and local residents on August 31, 1976. At this meeting, the findings of the study and the potential impact of the study results on the community were discussed. No opposition to the study findings was expressed.

On May 15, 1985, the results of this Type 19 Flood Insurance Study were reviewed and accepted at a final coordination meeting attended by representatives of the Study Contractor, FEMA, and the community.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the incorporated area of the City of Wilmington, New Hanover County, North Carolina. The area of study is shown on the Vicinity Map (Figure 1).

The City of Wilmington is affected by both storm surge and riverine flooding. Storm surge generated in the Atlantic Ocean propagates into Hewletts Creek, the Cape Fear and Northeast Cape Fear Rivers, and further propagates into Smith Creek and Bradley Creek. A detailed coastal flooding analysis was performed for the City of Wilmington, where the flooding source is the Atlantic Ocean.

Detailed riverine studies were included for the following streams:

- a) Smith Creek, within the corporate limits;
- b) Bradley Creek, within the corporate limits;
- c) Burnt Mill Creek, from the mouth at Smith Creek to Hoggard Drive;
- d) Spring Branch, within the corporate limits;
- e) Greenfield Lake North Branch, from the mouth at Greenfield Lake to just upstream of 16th Street; and,
- f) Greenfield Lake North Branch Tributary, from the mouth at Greenfield Lake North Branch to about 200 feet upstream of 16th Street.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards.

The areas studied were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through December 1988. The scope and methods of study were proposed to, and agreed upon, by FEMA and the City of Wilmington.

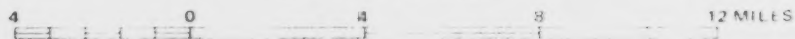


FIGURE 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER COUNTY)

APPROXIMATE SCALE



VICINITY MAP

3

2.2 Community Description

The City of Wilmington lies on the southeastern coastal plain of North Carolina, 8 miles west of the Atlantic Ocean. The city encompasses approximately 22 square miles and lies along the eastern bank of the Cape Fear River, 26 miles upstream of its mouth. Wilmington is bordered on all sides by the unincorporated areas of New Hanover County, except for a small portion along the western boundary where it borders Brunswick County.

The community was settled in 1733 on the eastern bank of the Cape Fear River near the confluence of the Northeast Cape Fear River. It was incorporated in 1740 and named for Spencer Compton, the Earl of Wilmington, who later became Prime Minister of England. Wilmington soon surpassed the older town of Brunswick, located downstream on the western bank of the Cape Fear River, as a seaport and population center. Chief occupations were shipping, farming, and the production of naval stores. The completion of the Wilmington and Weldon Railroad in 1840 brought increased trade and prosperity to Wilmington. During the Civil War, Wilmington was an important port for the Confederacy, where swift, shallow-draft vessels could outrun the Union blockade (Reference 1). Wilmington presently has a diversified, industrialized economy enhanced by access to the Cape Fear and Northeast Cape Fear Rivers and by the city's proximity to the Atlantic Ocean. According to the 1980 census, the population of the City of Wilmington is 44,000, as compared to 45,169 in 1970 (Reference 2).

The city has a mild climate with an average annual temperature of 64 degrees Fahrenheit and an average annual precipitation of approximately 54 inches (Reference 3).

The soil association located in the City of Wilmington is the Murville-Mascotte-Leon Association, which consists of very poorly drained to somewhat poorly drained sandy soils on uplands (Reference 4). This soil association is classified in SCS Group D (Reference 5).

Most of the city lies above the 100-year frequency flood elevation on a bluff rising above the Cape Fear River, in some areas to an elevation of 70 feet National Geodetic Vertical Datum of 1929 (NGVD). However, some development has also occurred within the 100-year flood plain in areas adjacent to the river and along the tributaries. This development includes park facilities, wharves, warehouses, storage tanks, commercial establishments, and residences.

2.3 Principal Flood Problems

The dominant flooding source in Wilmington is storm surge generated in the Atlantic Ocean by hurricanes and other severe windstorms that are propagated up Hewletts Creek and the Cape Fear River and into its tributaries. The highest tide of record occurred during Hurricane Hazel in 1954 when the Cape Fear River reached approximately 7 feet NGVD at the foot of Castle Street. Storm surges also caused flooding at Greenfield Lake and along Smith Creek and the lower portions of Burnt Mill Creek.

In addition to flooding from storm surge, Burnt Mill Creek, Spring Branch, Greenfield Lake North Branch and its tributary, and Bradley Creek are subject to flooding from stream overflow during heavy rainfalls. Heavy local thunderstorms resulted in major flooding along the upper segments of Burnt Mill Creek on June 16, 1969. Due to the estuarine nature of the Cape Fear and Northeast Cape Fear Rivers, floodflows from upstream have a negligible effect on river stages at Wilmington.

2.4 Flood Protection Measures

Local drainage and flood control projects involving stream channelization have been constructed by the city on portions of Burnt Mill Creek. There are no other projects that provide flood protection for Wilmington.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude that are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood that equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community. Analyses were also carried out to establish the peak elevation-frequency relationships for each coastal flooding source studied in detail.

Because there are no stream gages within the study area, generalized criteria developed from records ranging from 14 to 39 years from 77 gages in the coastal plain gaging network in North Carolina were used in the statistical analyses. The log-Pearson Type III method was used (Reference 6). Peak discharges were verified by an independent determination using U.S. Weather Bureau rainfall frequency data and synthetic unit hydrograph procedures.

Peak discharges for the 10-, 50-, 100-, and 500-year floods of each riverine flooding source studied in detail in the community are shown in Table 1.

TABLE 1 - SUMMARY OF DISCHARGES

<u>FLOODING SOURCE AND LOCATION</u>	<u>DRAINAGE AREA</u>	<u>PEAK DISCHARGES (CFS)</u>			
	<u>SQ MILES</u>	<u>10-YEAR</u>	<u>50-YEAR</u>	<u>100-YEAR</u>	<u>500-YEAR</u>
SPRING BRANCH at mouth	3.01	660	1,280	1,600	2,580
BURNT MILL CREEK at mouth	6.66	1,260	2,350	2,930	4,630
GREENFIELD LAKE NORTH BRANCH at East Lake Shore Drive	1.19	480	980	1,250	2,090
GREENFIELD LAKE NORTH BRANCH TRIBUTARY at mouth	0.24	230	500	690	1,200
BRADLEY CREEK at mouth	5.53	840	1,600	2,020	3,200

Inundation above the usual astronomic tide level from the Atlantic Ocean caused by passage of storms (storm surge) was determined by the joint probability method (Reference 7). The storm populations were described by probability distributions of 5 parameters that influence surge heights. These were central pressure depression (which measures the intensity of the storm), radius to maximum winds, forward speed of the storm, shoreline crossing point, and crossing angle. These characteristics were described statistically based on an analysis of observed storms in the vicinity of storms that have passed near the southern coast of North Carolina. Primary sources of data for this were the National Weather Service and the Mariners Weather Log. The National Weather Service provided information on tropical cyclones of the North Atlantic Ocean from 1871 to 1977, and on storms from 1886 through 1979 (References 8, 9, and 10). The Mariners Weather Log provided information on North Atlantic Tropical Cyclones in 1978 and 1979 (References 11 and 12).

A summary of the parameters used for the area is presented in Table 2, Parameter Values for Surge Elevations.

For areas subject to flooding directly from the Atlantic Ocean, the FEMA standard storm surge model was used to simulate the coastal surge generated by any chosen storm (that is, any combination of the 5 storm parameters defined previously). By performing such simulations for a large number of storms, each of known total probability, the frequency distribution of surge height can be established as a function of coastal location. These distributions incorporate the large-scale surge behavior, but do not include an analysis of the added effects associated with much finer scale wave phenomena, such as wave height or runup. As the final step in the calculations, the astronomic tide for the region is then statistically combined with the computed storm surge to yield recurrence intervals of total water level (Reference 13).

The storm-surge elevations for the 10-, 50-, 100-, and 500-year floods have been determined for the City of Wilmington and are shown in Table 3, Summary of Stillwater Elevations. The analyses reported herein reflect the stillwater elevations due to tidal and wind setup effects and do not include the contributions from wave action effects.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the riverine sources studied were carried out to provide estimates of the elevations of the floods of the selected recurrence intervals.

Cross-section data for streams were obtained from field surveys, as were elevation data and structural geometry on bridges and culverts.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles. For stream segments for which a floodway was computed (Section 4.2), selected cross-section locations are also shown on the Flood Boundary and Floodway Map.

CENTRAL PRESSURE DEPRESSION (MILLIBARS)	5	15	25	35	45	55	65	75	85
AVERAGE ASSIGNED PROBABILITIES*	0.167	0.167	0.167	0.144	0.125	0.123	0.065	0.033	0.009
STORM RADIUS TO MAXIMUM WINDS (NAUTICAL MILES)	20				35				
PROBABILITY	0.51				0.49				
FORWARD SPEED (KNOTS)	10			20			30		
PROBABILITIES: ENTERING ALONGSHORE EXITING	0.700 0.551 0.463			0.250 0.306 0.370			0.050 0.143 0.167		
DIRECTION OF STORM PATH (DEGREES FROM TRUE NORTH)	ENTERING			ALONGSHORE			EXITING		
	276	312	348	24			60		
PROBABILITY	0.033	0.041	0.089	0.398			0.439		
FREQUENCY OF STORM OCCURRENCE (STORMS/NAUTICAL MILE/YEAR)	0.18(10 ⁻³)	0.19(10 ⁻³)	0.41(10 ⁻³)	2.17(10 ⁻³)			1.94(10 ⁻³)		

*AVERAGE OF ENTERING ALONGSHORE, AND EXITING PROBABILITIES

TABLE 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

PARAMETER VALUES FOR SURGE ELEVATIONS

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FLOODING SOURCE AND LOCATION	TRANSECT	STILLWATER ELEVATION (FEET NGVD)			
		10% (10 YEAR)	2% (50 YEAR)	1% (100 YEAR)	0.2% (500 YEAR)
NORTHEAST CAPE FEAR RIVER					
From mouth of Smith Creek to Third Street crossing	N/A	6.4	8.5	9.3	10.7
From U.S. Route 117 to mouth at Cape Fear River	N/A	6.6	8.8	9.5	10.9
CAPE FEAR RIVER					
From mouth of Northeast Cape Fear River to 5 miles downstream	N/A	6.6	8.8	9.5	10.9
In the southernmost portion of the city, in the vicinity of Barnards Creek	N/A	6.6	9.0	9.9	11.4
ATLANTIC OCEAN/HEWLETTS CREEK					
Within community	N/A	6.6	9.6	10.8	13.3

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

SUMMARY OF STILLWATER ELEVATIONS

**NORTHEAST CAPE FEAR RIVER — CAPE FEAR RIVER —
ATLANTIC OCEAN / HEWLETTS CREEK**

Water-surface profiles for the 10-, 50-, 100-, and 500-year floods were developed using the COE HEC-2 computer program (Reference 14). Roughness coefficients (Manning's "n") were determined from field inspection and generally ranged from 0.055 to 0.06 in the main channels and from 0.07 to 0.22 in the overbank areas.

Flood profiles were drawn showing the computed water-surface elevations for floods of the selected recurrence intervals. Flood profiles were not shown for the Cape Fear River, Northeast Cape Fear River, Smith Creek Greenfield Lake, and Hewletts Creek because they are totally dominated by coastal surge effects.

The hydraulic analyses for the riverine study are based only on the effects of unobstructed flow. The flood elevations shown on the profiles are, thus, considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

Hydraulic analyses, considering storm characteristics and the shoreline and bathymetric characteristics of the flooding sources studied, were carried out to provide estimates of the elevations of floods of the selected recurrence intervals along each of the shorelines.

Although northeasters (winter storms) are more diffuse and less intense than hurricanes, they occur more frequently and cover larger areas and longer coastal reaches at one time. However, in Wilmington, the effects of northeasters on the 100-year storm surge elevations are insignificant.

The FEMA storm surge model was utilized to simulate the hydrodynamic behavior of the surge generated by the various synthetic storms. This model utilizes a grid pattern approximating the geographical features of the study area and the adjoining areas. Surges were computed utilizing grids of 5 nautical miles. Surge was then propagated through a second 2 nautical mile grid covering an extensive portion of coastal North Carolina, including the outer barrier islands and the entire Albemarle Sound system. Finally, a finer 1 nautical mile grid was used to adequately represent conditions (through model calibration/verification runs) in the study area (Reference 13).

Underwater depths and land heights for the model grid systems were obtained from USGS quadrangle sheets (Reference 15), NOAA nautical charts (Reference 16), and from aerial photographs (Reference 17). The results of this study are considered accurate until local topography, vegetation, or cultural development undergo any major changes.

Wave height analyses were not performed in the study area because it was determined that peak wave generating conditions are not coincident with peak stillwater conditions.

All elevations are referenced to NGVD. Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The National Flood Insurance Program encourages state and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes. The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections the boundaries were interpolated using USGS topographic maps at a scale of 1:24000 and a contour interval of 5 feet (Reference 15).

The approximate delineations on Burnt Mill Creek upstream of Hoggard Drive were obtained from the City of Wilmington Type 15 Flood Insurance Study (Reference 18).

This 100-year and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map. In cases where the 100- and 500-year flood boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces the flood-carrying capacity, increases the flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the National Flood Insurance Program, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream plus any adjacent flood plain areas that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced.

The floodways presented in this study were computed on the basis of equal conveyance reduction from each side of the flood plain. The results of these computations were tabulated at selected cross sections for each stream segment for which a floodway was computed and are presented in Table 4, Floodway Data.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
BRADLEY CREEK								
A	16,765	85 ²	477	2.1	21.2	21.2	22.1	0.9
BURNT MILL CREEK								
A	100	180	1047	2.8	9.3	2.0 ³	2.8	0.8
B	2715	350	2172	1.4	9.3	7.4 ³	8.3	0.9
C	3420	449	2373	1.3	9.3	8.5 ³	9.1	0.6
D	5700	368	2406	1.2	9.8	9.8	10.5	0.7
E	6800	680	5981	0.5	10.3	10.3	11.1	0.8
F	7386	367	2346	1.1	10.3	10.3	11.1	0.8
G	8333	165	1242	2.1	11.2	11.2	12.0	0.8
H	9832	250	1507	1.5	11.9	11.9	12.7	0.8
I	11,925	200	1421	1.4	13.2	13.2	14.0	0.8
J	13,645	90	752	2.7	14.6	14.6	15.3	0.7
K	14,450	130	776	2.4	16.3	16.3	17.2	0.9
L	15,810	115	439	4.3	18.2	18.2	18.9	0.7
M	18,000	165	631	3.0	25.7	25.7	26.4	0.7
N	19,820	135	698	1.7	30.1	30.1	30.8	0.7

¹FEET ABOVE MOUTH

²THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

³ELEVATIONS WITHOUT CONSIDERING COASTAL STORM SURGE EFFECT FROM NORTHEAST CAPE FEAR RIVER

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

FLOODWAY DATA

BRADLEY CREEK — BURNT MILL CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET SEC. ¹)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE (FEET)
SMITH CREEK								
A	8700	168 ²	2790	1.9	9.3	2.4 ³	3.3	0.9
B	15,000	156 ²	1918	2.7	9.3	2.9 ³	3.8	0.9
C	20,100	159 ²	2071	1.8	9.3	3.4 ³	4.2	0.8
SPRING BRANCH								
A	4200	155 ²	822	1.9	13.1	13.1	13.8	0.7
B	4900	235 ²	1041	1.5	15.1	15.1	15.6	0.5

¹FEET ABOVE MOUTH

²THIS WIDTH EXTENDS BEYOND CORPORATE LIMITS

³ELEVATIONS WITHOUT CONSIDERING COASTAL STORM SURGE EFFECT FROM NORTHEAST CAPE FEAR RIVER

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

FLOODWAY DATA

SMITH CREEK—SPRING BRANCH

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE ¹	WIDTH (FEET)	SECTION AREA (SQ. FEET)	MEAN VELOCITY (FEET SEC.)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	DIFFERENCE (FEET)
GREENFIELD LAKE NORTH BRANCH								
A	100	220	1239	1.0	14.1	14.1	14.1	0.0
B	2053	95	657	1.7	15.9	15.9	16.8	0.9
GREENFIELD LAKE NORTH BRANCH TRIBUTARY								
A	933	120	545	1.2	23.6	23.6	24.4	0.8

¹FEET ABOVE MOUTH

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

FLOODWAY DATA

**GREENFIELD LAKE NORTH BRANCH — GREENFIELD LAKE
NORTH BRANCH TRIBUTARY**

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As shown on the Flood Boundary and Floodway Map, the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and the 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown. Portions of the floodway of Spring Branch, Smith Creek, and Bradley Creek lie outside the corporate limits.

The area between the floodway and the 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe thus encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 2.

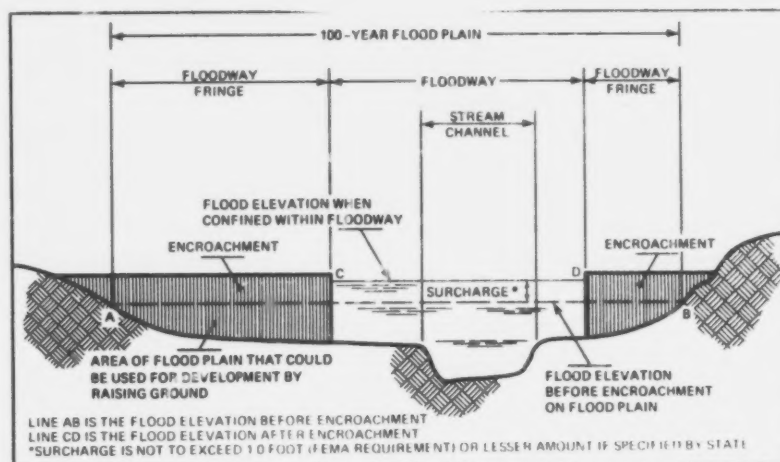


FIGURE 2 - Floodway Schematic

The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting the City of Wilmington.

5.1 Reach Determinations

For riverine studies, reaches are defined as sections of flood plain that have relatively the same flood hazard, based on the weighted average difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

<u>Average Difference Between 10- and 100-year Floods</u>	<u>Variation</u>
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the flooding sources of the City of Wilmington are shown on the Flood Profiles and summarized in Table 5, Flood Insurance Zone Data and Table 6, Coastal Flood Insurance Zone Data.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a riverine reach is the weighted average difference between the 10- and 100-year flood water-surface elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code.

The FHF for areas subject only to storm surge flooding is the difference between the 10- and 100-year stillwater elevations rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code. For areas with wave heights less than 3 feet, the FHF is the weighted average difference between the 100-year wave crest elevation and the 10-year stillwater elevation. For areas with wave heights greater than 3 feet, the FHF is determined using the difference between the 10- and 100-year stillwater elevations multiplied by 1.55, then rounded to the nearest 0.5 foot, multiplied by 10, and shown as a 3-digit code.

For example, if the difference between elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated

with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

- Zone A:** Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations are shown or FHFs determined.
- Zones A4 - A8:** Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
- Zone B:** Areas between Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- and 500-year floods by dike, levee, or other water control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas of less than 1 square mile. Zone B is not subdivided.
- Zone C:** Areas of minimal flooding; not subdivided.

Flood elevation differences, FHFs, flood insurance zones, and base flood elevations for the flooding sources studied in detail in the community are shown in Table 5, Flood Insurance Zone Data, and Table 6, Coastal Flood Insurance Zone Data.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for the City of Wilmington is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines for riverine flooding sources show the locations of the expected whole-foot water-surface elevations of the base (100-year) flood. For coastal flooding sources, the expected water-surface elevations of the base (100-year) flood are shown as a weighted average within zones. Each whole-foot elevation is delineated except where cartographic considerations require the combination of two or more elevation zones. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the National Flood Insurance Program.

FLOODING SOURCE	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 1.0% (100 YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (NGVD)
		10% (10-YEAR)	2% (50 YEAR)	0.2% (500 YEAR)			
BRADLEY CREEK REACH 1	0005	-2.1	-0.6	1.2	020	A4	VARIES-SEE MAP
BURNT MILL CREEK REACH 1	0005	-2.7	-0.8	1.7	025	A5	VARIES-SEE MAP
SPRING BRANCH REACH 1	0005	-2.0	-0.6	1.3	020	A4	VARIES-SEE MAP
GREENFIELD LAKE NORTH BRANCH REACH 1	0005	-2.7	-0.4	1.5	025	A5	VARIES-SEE MAP
GREENFIELD LAKE NORTH BRANCH TRIBUTARY REACH 1	0005	-2.5	-0.7	1.3	025	A5	VARIES-SEE MAP

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE

³ROUNDED TO NEAREST FOOT

TABLE 5

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

FLOOD INSURANCE ZONE DATA

BRADLEY CREEK — BURNT MILL CREEK — SPRING BRANCH — GREENFIELD LAKE
NORTH BRANCH — GREENFIELD LAKE NORTH BRANCH TRIBUTARY

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FLOODING SOURCE	TRANSECT	PANEL ¹	ELEVATION DIFFERENCE ² BETWEEN 10% (100 YEAR) FLOOD AND 10% (10 YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION ³ (FEET NGVD)
NORTHEAST CAPE FEAR RIVER	N/A	0005	-2.9	030	A6	9
	N/A	0005	-2.9	030	A6	10
CAPE FEAR RIVER	N/A	0005,0010	-2.9	030	A6	10
	N/A	0010	-3.3	035	A7	10
ATLANTIC OCEAN/ HEWLETTS CREEK	N/A	0005	-4.2	040	A8	11

¹FLOOD INSURANCE RATE MAP PANEL

²WEIGHTED AVERAGE IN FEET

³ROUNDED TO NEAREST FOOT

⁴DUE TO MAP SCALE LIMITATIONS, BASE FLOOD ELEVATIONS SHOWN ON MAP MAY REPRESENT AVERAGE ELEVATIONS FOR THE ZONES DEPICTED

TABLE 6

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

COASTAL FLOOD INSURANCE ZONE DATA

**NORTHEAST CAPE FEAR RIVER — CAPE FEAR RIVER —
ATLANTIC OCEAN / HEWLETTS CREEK**

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6.0 OTHER STUDIES

A Flood Insurance Study was prepared for the City of Wilmington by the COE, Wilmington District, in 1978 (Reference 18). This Flood Insurance Study revises the coastal base flood elevations as a result of current methodology. The riverine portion of the 1978 study is not affected by this revision.

Some flood related studies that concern the study area include the Storm Tide Frequency Analysis for the North Carolina Coast by NOAA (Reference 19) and the National Shoreline Study by the COE (Reference 20).

A Flood Insurance Study has been published for New Hanover County, Unincorporated Areas, North Carolina (Reference 21). That study is currently being revised (Reference 22). A Flood Insurance Study is in progress for Brunswick County, Unincorporated Areas, North Carolina (Reference 23). The results of those studies are in agreement with the results of this study.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, Federal Emergency Management Agency, 1371 Peachtree Street, N.E., Suite 736, Atlanta, Georgia 30309.

8.0 REFERENCES AND BIBLIOGRAPHY

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17. Tetra Tech, Inc., Aerial Photographs, Scale 1:24000, November 1980.
18. U.S. Department of Housing and Urban Development, Federal Insurance Administration, Flood Insurance Study, City of Wilmington, New Hanover County, North Carolina, April 1978.
19. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Storm Tide Frequency Analysis for the North Carolina Coast, South of Cape Lookout, 1975.
20. U.S. Army Corps of Engineers, South Atlantic Division, National Shoreline Study Regional Inventory Report: South Atlantic Gulf Region, Puerto Rico and the Virgin Islands, 1971.
21. Federal Emergency Management Agency, Flood Insurance Study, New Hanover County, Unincorporated Areas, North Carolina, October 1983.

22. ———, Flood Insurance Study, New Hanover County, Unincorporated Areas, North Carolina, in progress.
23. ———, Flood Insurance Study, Brunswick County, Unincorporated Areas, North Carolina, in progress.

9.0 REVISIONS DESCRIPTION

This section has been added to provide information regarding significant revisions made since the original Flood Insurance Study was printed. Future revisions may be made that do not result in the republishing of the Flood Insurance Study report. To assure that any user is aware of all revisions, it is advisable to contact the community repository of flood hazard data located at the Engineering Department, Wilmington, North Carolina.

9.1 First Revision (Revised November 4, 1987)

a. Acknowledgments

The hydraulic analysis for this Revisions Description was obtained from Mr. Robert F. Coleman, Jr., Director of Public Works, City of Wilmington, North Carolina. The Federal Emergency Management Agency (FEMA) reviewed and accepted these data for purposes of this revision.

b. Scope

As a result of the hydraulic analyses of Burnt Mill Creek for the City of Wilmington, the floodway and base flood elevations have been revised. The area from Colonial Drive to approximately 1,750 feet upstream of Mercer Avenue was revised to reflect this reanalysis.

c. Hydraulic Analyses

A HEC-2 hydraulic reanalysis of Burnt Mill Creek was performed for the City of Wilmington by the U.S. Army Corps of Engineers (Reference 1). The reanalysis was undertaken because of changes to the channel and floodplain for the area.

This reanalysis resulted in the generation of a revised Floodway Data Table and flood profile for Burnt Mill Creek.

d. Floodways

Floodway widths for Burnt Mill Creek were revised as a result of the restudy of the creek. The results of the analysis are presented in Table 4, Floodway Data.

e. Other Studies

This revision is completely within the City of Wilmington, North Carolina, and does not affect any other Flood Insurance Studies for the contiguous communities.

f. References and Bibliography

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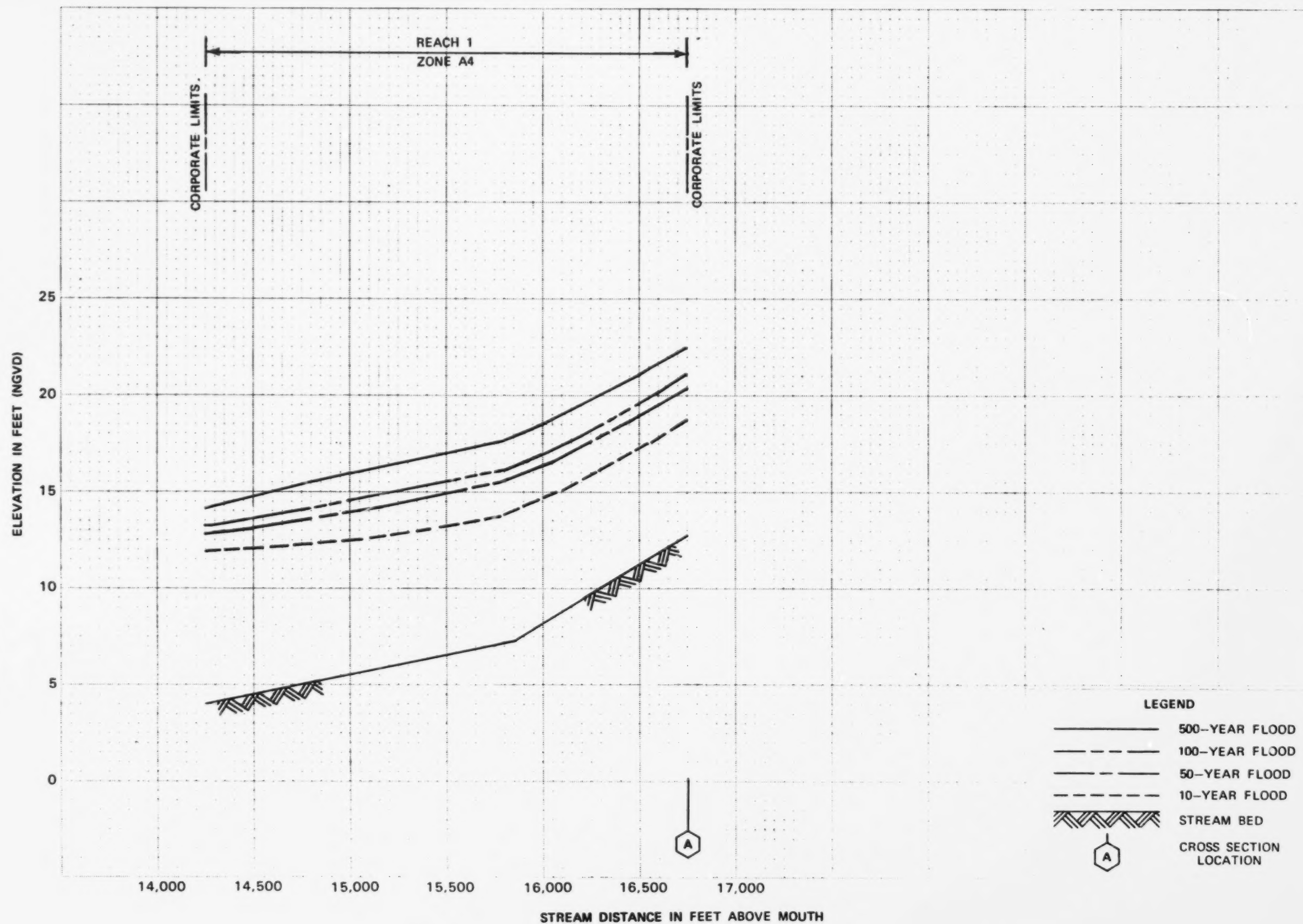
FLOOD PROFILES

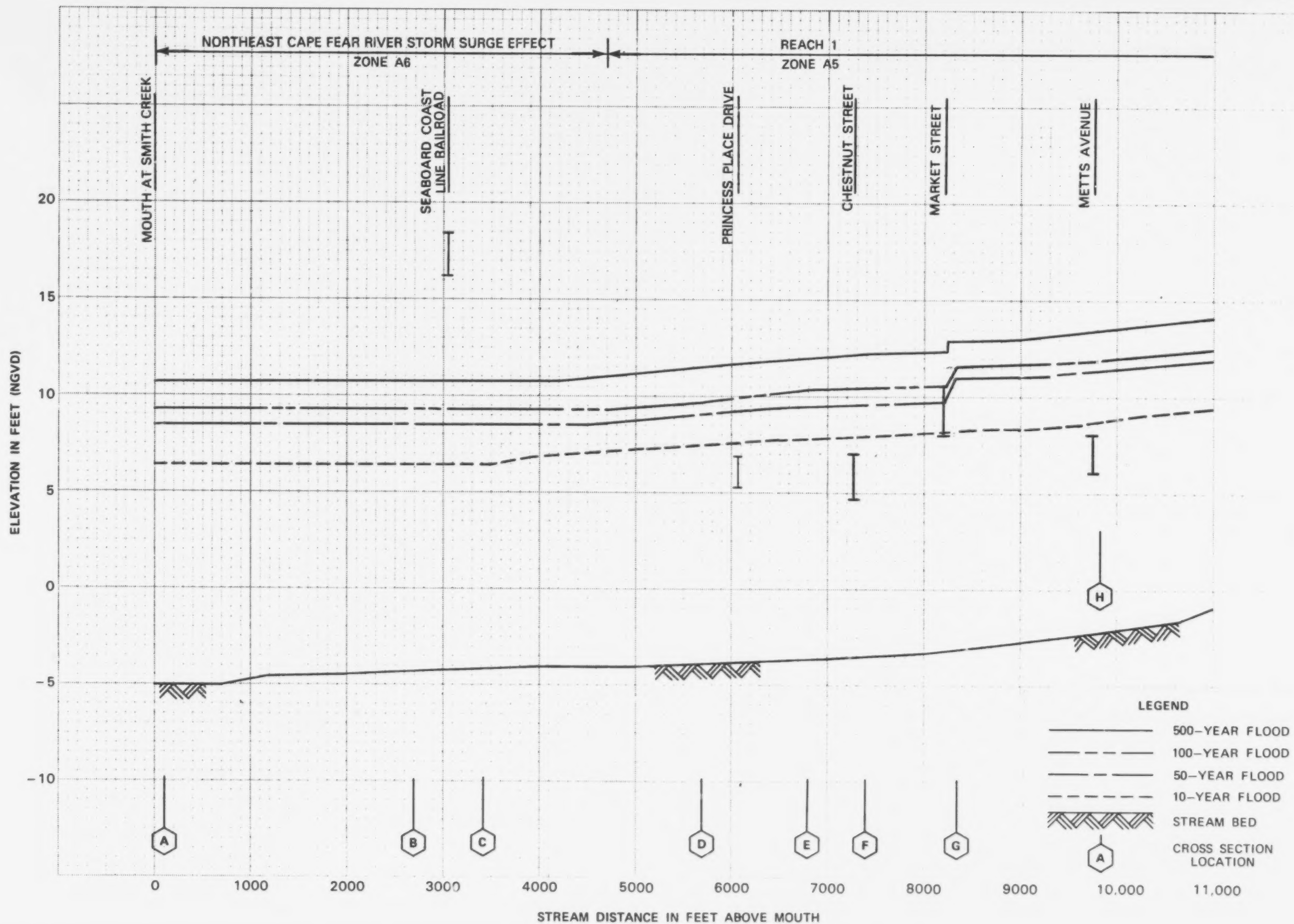
BRADLEY CREEK

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(NEW HANOVER CO.)

01P





FLOOD PROFILES

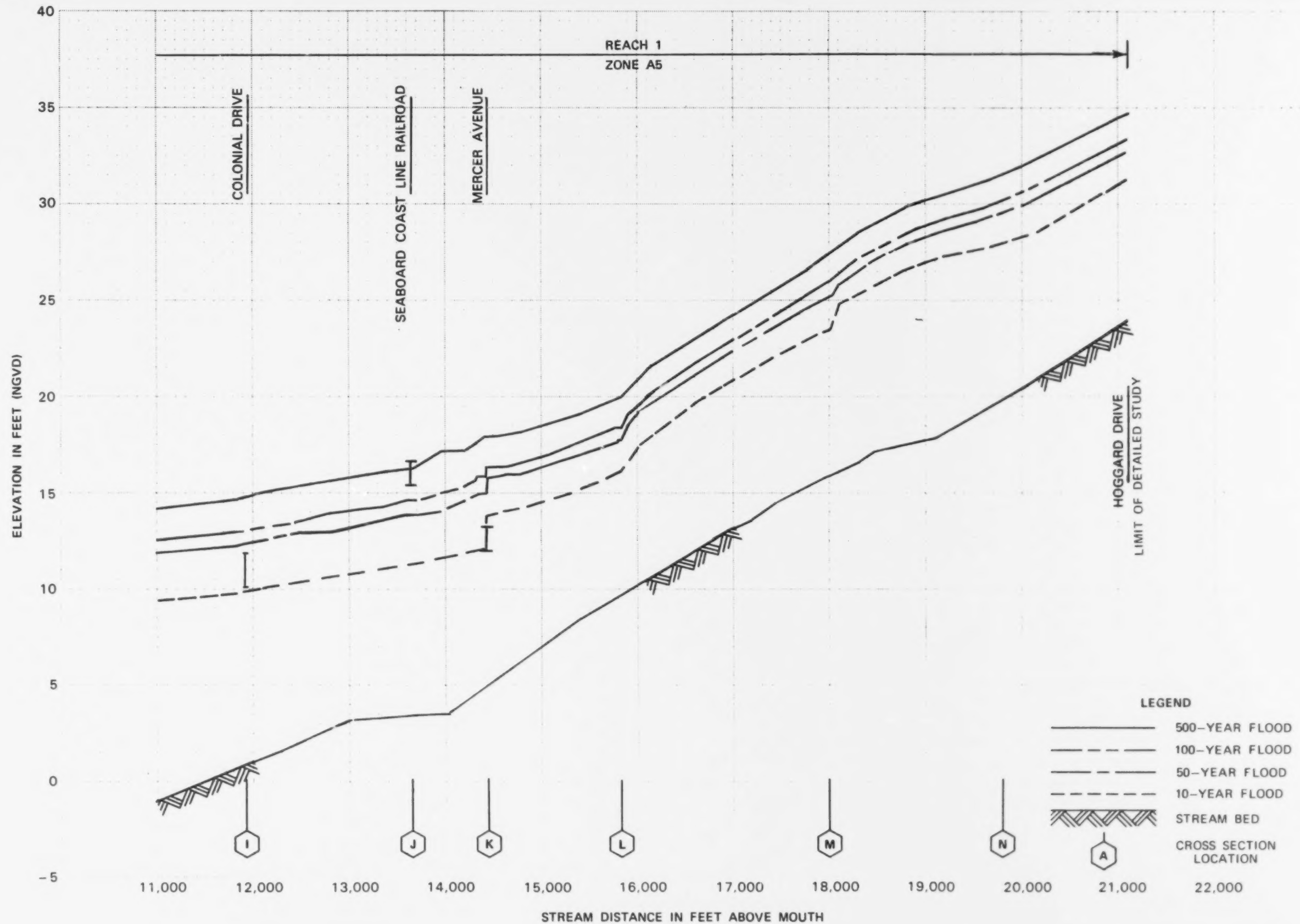
BURNT MILL CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC

(NEW HANOVER CO.)

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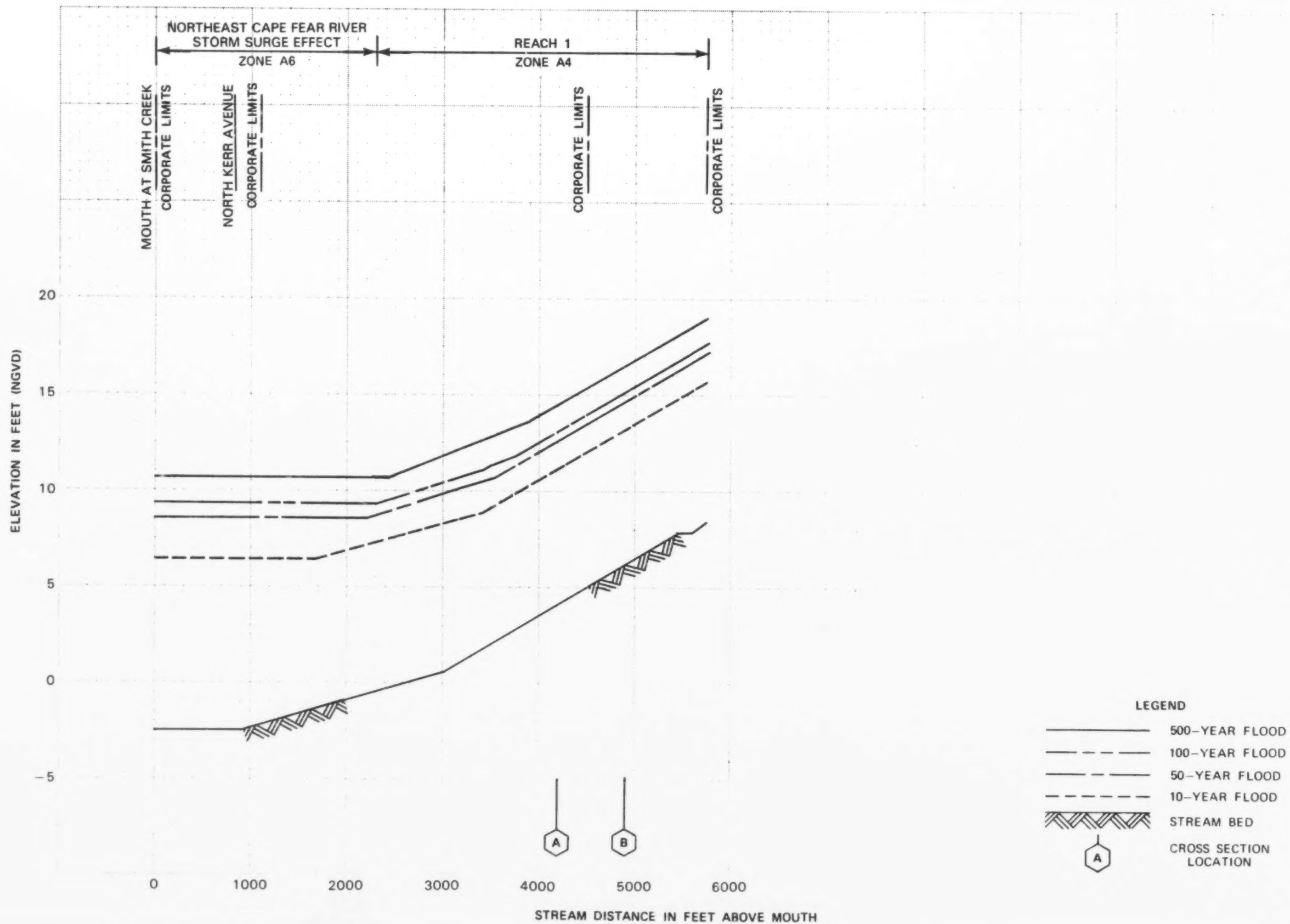
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BURNT MILL CREEK

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(NEW HANOVER CO.)

03P



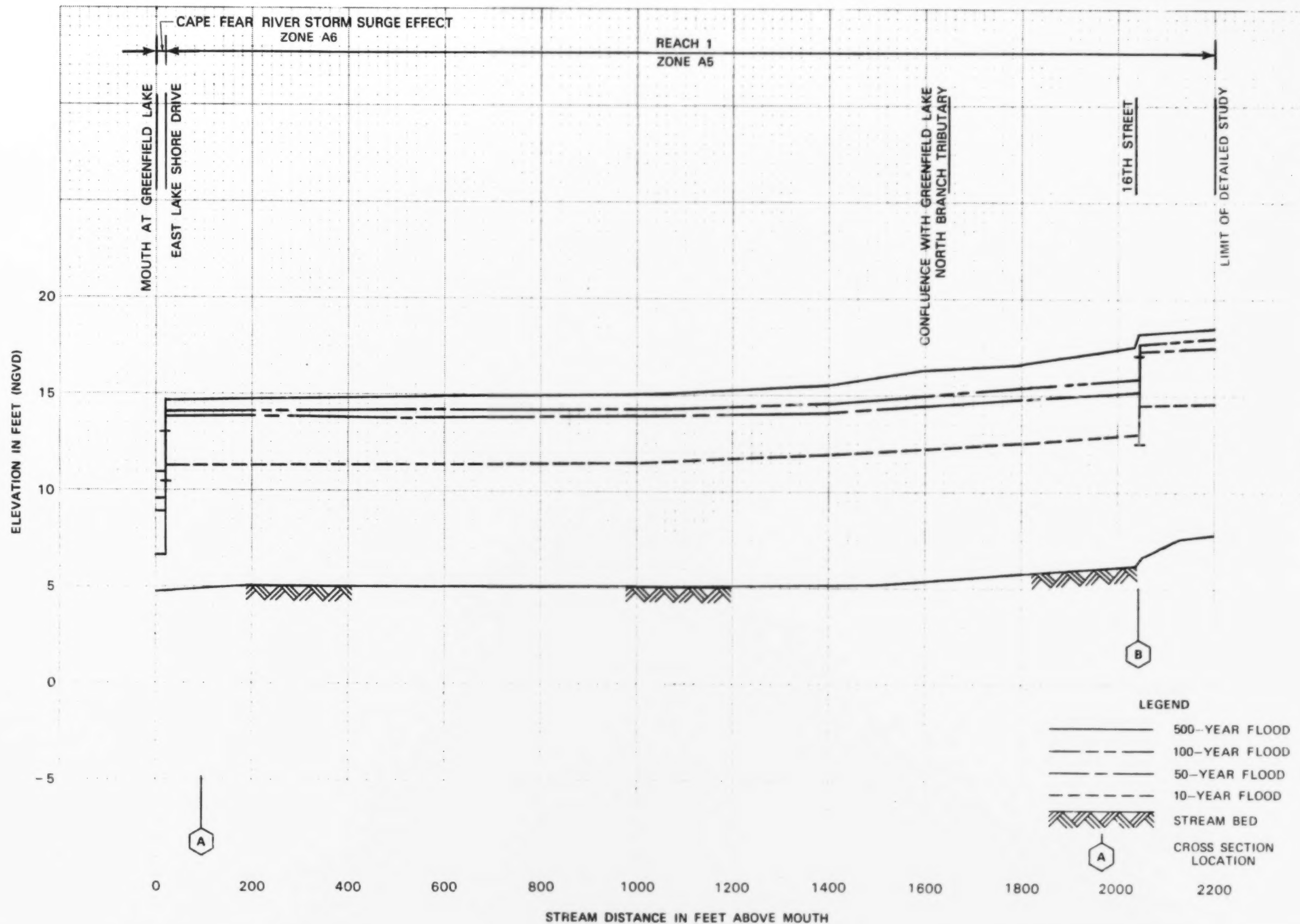
FLOOD PROFILES

SPRING BRANCH

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

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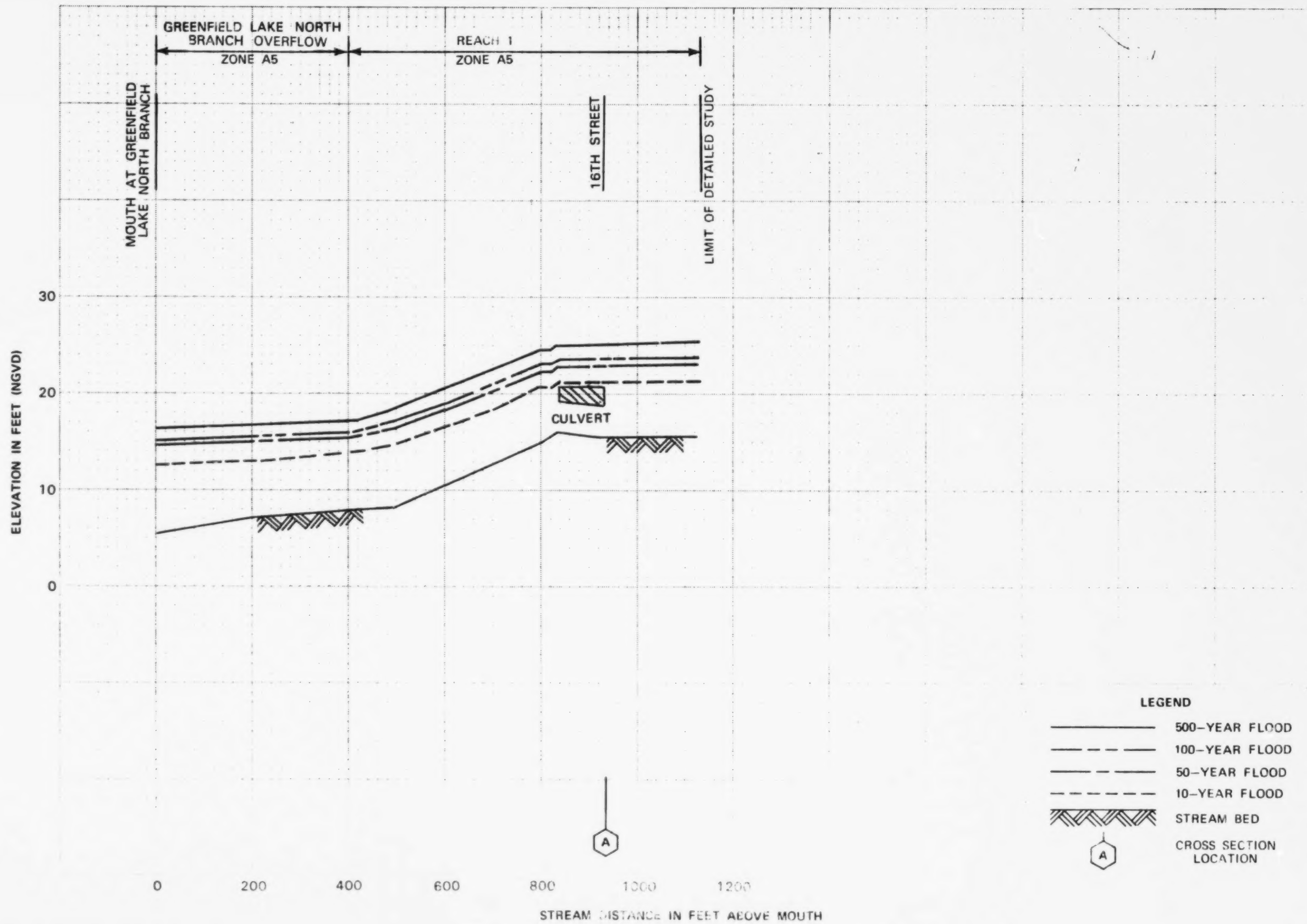


FEDERAL EMERGENCY MANAGEMENT AGENCY
CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

FLOOD PROFILES

GREENFIELD LAKE NORTH BRANCH

05P



FLOOD PROFILES

GREENFIELD LAKE NORTH BRANCH TRIBUTARY

FEDERAL EMERGENCY MANAGEMENT AGENCY

CITY OF WILMINGTON, NC
(NEW HANOVER CO.)

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